TABLE 1

Numbers and Percentages of U.S.-Trained Physicians Practicing in 1982 in the Same State Where They Had Received Their Medical School and/or Residency Training, by Personal and Professional Characteristics of the Physicians and Characteristics of the Medical Schools and the States

Descriptor	Practicing Physicians*							
	Total	Medical School†		Residency‡		Medical School and Residency§	
		No.	Percent	No.	Percent	No.	Percent
All physicians	294,650	115,737	39.3	150,509	51.1	87,430	29.7
Physician characteristics							
Sex							
Male	269,610	105,746	39.2	135,494	50.3	78,952	29.3
Female	25,040	9,991	39.9	15,015	60.0	8,478	33.9
Years since medical school graduation							
≤10	104,805	42,270	40.3	59,333	56.6	32,925	31.4
11–20	71,746	26,155	36.5	33,616	46.9	19,051	26.6
21–30	58,853	23,605	40.1	29,163	49.6	17,632	30.0
31–40	42,338	16,312	38.5	19,829	46.8	12,119	28.6
41–50	14,807	6,389	43.1	7,404	50.0	4,887	33.0
>50	2,101	1,006	47.9	1,164	55.4	816	38.8
Practice specialty							
General/family practice	44,909	22,005	49.0	25,028	55.7	16,133	35.9
Internal medicine	64,292	24,349	37.9	33,568	52.2	18,830	29.3
Surgery	62,224	23,763	38.2	28,982	46.6	17,243	27.7
Pediatrics	19,455	7,280	37.4	9,835	50.6	5,561	28.6
Obstetrics/gynecology	18,737	7,908	42.2	10,292	54.9	6,364	34.0
Radiology	15,962	5,920	37.1	7,839	49.1	4,570	28.6
Psychiatry	21,655	7,729	35.7	12,390	57.2	6,237	28.8
Anesthesiology	9,654	3,675	38.1	5,099	52.8	2,862	29.6
Other	37,762	13,108	34.7	17,476	46.3	9,630	25.5
School characteristics							
Type of medical school							
U.S. public	146,330	69,712	47.6	77,693	53.1	50,560	34.6
U.S. private	148,320	46,025	31.0	72,816	49.1	36,870	24.9
Reputation of medical school							
'Elite'	37,760	12,736	33.7	17,648	46.7	10,102	26.8
'Non-elite'	256,890	103,001	40.1	132,861	51.7	77,328	30.1

* All column percentages are computed by dividing the number in the column by the number in the total column at left.

† This column consists of (*a*) physicians who had completed only medical school in the state and (*b*) physicians who had completed both medical school and residency in the state. The latter group is also included in the next column and makes up the column at the extreme right.

‡ This column consists of (*a*) physicians who had completed only the residency in the state and (*b*) physicians who had completed both residency and medical school in the state. The latter group is also included in the preceding column and makes up the column at right.

§ All the physicians in this column are also included in the preceding two columns.

TABLE 1—*Continued*

Descriptor	Practicing Physicians*						
	Total	Medical School†		Residency‡		Medical School and Residency§	
		No.	Percent	No.	Percent	No.	Percent
State characteristics							
Population							
Lowest 20 percent	9,919	1,218	12.3	1,936	19.5	812	8.2
Second 20 percent	17,922	5,957	33.2	6,093	34.0	3,519	19.6
Third 20 percent	44,543	15,119	33.9	18,773	42.1	10,024	22.5
Fourth 20 percent	66,470	28,330	42.6	32,138	48.3	20,234	30.4
Highest 20 percent	155,796	65,113	41.8	91,569	58.8	52,841	33.9
Physician-population ratio							
Lowest 20 percent	20,881	8,620	41.3	7,959	38.1	5,872	28.1
Second 20 percent	27,964	13,778	49.3	12,062	43.1	9,366	33.5
Third 20 percent	69,034	31,276	45.3	35,858	51.9	22,615	32.8
Fourth 20 percent	68,742	27,017	39.3	34,035	49.5	20,735	30.2
Highest 20 percent	108,029	35,046	32.4	60,595	56.1	28,842	26.7
Per capita income							
Lowest 20 percent	25,383	10,363	40.8	9,977	39.3	6,723	26.5
Second 20 percent	36,079	15,680	43.5	15,511	43.0	10,727	29.7
Third 20 percent	73,425	31,524	42.9	35,361	48.2	23,487	32.0
Fourth 20 percent	81,635	36,573	44.8	50,218	61.5	29,209	35.8
Highest 20 percent	78,128	21,597	27.6	39,442	50.5	17,284	22.1

plicit retention programs by public schools. Little difference existed between the two types of schools when retention after residency was compared.

The reputation of a medical school was also related to the physicians' practice locations. The "elite" schools in Table 1 were defined as the 10 schools receiving the highest scores in a survey of medical school faculties conducted by Cole and Lipton (13). Physicians who attended "non-elite" schools had a higher propensity than those from "elite" schools to practice in the state where they graduated from medical school, where they received their residency training, or both.

The characteristics of the state affected the physician's choice to practice there. Table 1 shows three such characteristics: population, physician density, and economic prosperity. Physicians in the more populous states tended to have been trained in the state. Only 12 percent of the physicians in the 10 least populated states went to medical school in the state where they practiced; fewer than 20 percent completed residency there. On the other hand, 42 percent of physicians practicing in the 10 most populous states graduated from a medical school in the state where they practiced; almost 60 percent completed residency there; and over one-third pursued both undergraduate and graduate medical education in the state.

Data on the relation between location of training and location of practice were conflicting when states were ranked by physician density. The states with the highest physician-to-population ratio had the lowest percentage of practicing physicians who had graduated from medical school in the state. However, these states

had the highest percentage of physicians who had completed most of their graduate training in the state.

Finally, greater economic prosperity in a state, as measured by per capita income, correlated with a higher percentage of the state's practicing physicians who were trained there. However, in each category of training, the 10 states with the highest income had a smaller percentage of their physicians who were trained in the state than did the next 10 richest states.

Table 2 presents data for 11 states chosen by the authors to illustrate the range of variations among the states regarding the location of their physicians' training. The contrasts are striking. Less than 6 percent of the U.S.-trained physicians practicing in Arizona attended medical school there. This finding was not surprising given the newness of the one medical school in the state and the recent migration of physicians to the southern and southwestern states (14). On the other hand, 74 percent of U.S.-trained physicians in Nebraska graduated from medical school there.

Some states clearly had a physician population made up predominantly of those who trained in the state: Illinois, Louisiana, New York, and Pennsylvania. Others—for example, Connecticut, Florida, Oregon, and Washington—were populated by physicians educated outside their borders. But some state showed more complex patterns of retention. California, for example, had a lower-than-average percentage (27.1 percent, compared with the national average of 39.3 percent) of practicing physicians who attended medical school in the state but a higher-than-average percentage (58.6 per-

TABLE 2

Numbers and Percentages of U.S.-Trained Physicians Practicing in 11 Selected States in 1982 Who Had Received Medical School and/or Residency Training in the Respective State

States	Total	Practicing Physicians*					
		Medical School†		Residency‡		Medical School and Residency§	
		No.	Percent	No.	Percent	No.	Percent
Arizona	3,971	224	5.6	907	22.8	151	3.8
California	41,998	11,365	27.1	24,606	58.6	9,676	23.0
Connecticut	5,188	539	10.4	1,935	37.3	344	6.6
Florida	11,912	1,690	14.2	3,506	29.4	1,086	9.1
Illinois	11,336	6,993	61.7	7,188	63.4	5,598	49.4
Louisiana	5,096	3,545	69.6	3,272	64.2	2,817	55.3
Nebraska	1,932	1,426	73.8	963	49.8	888	46.0
New York	23,843	13,627	57.2	18,738	78.6	11,913	50.0
Oregon	4,184	1,137	27.2	1,515	36.2	647	15.5
Pennsylvania	15,841	10,284	64.9	11,293	71.3	8,726	55.1
Washington	6,679	1,184	17.7	2,444	36.6	591	8.8

* All column percentages are computed by dividing the number in the column by the number in the total column at left.

† This column consists of (*a*) physicians who had completed only medical school in the state and (*b*) physicians who had completed both medical school and residency in the state. The latter group is also included in the next column and makes up the column at the extreme right.

‡ This column consists of (*a*) physicians who had completed only the residency in the state and (*b*) physicians who had completed both residency and medical school in the state. The latter group is also included in the preceding column and makes up the column at right.

§ All the physicians in this column are also included in the preceding two columns.

TABLE 3

Percentages of Active Physicians Trained in 11 Selected States Who Were Practicing in the Respective State in 1982

State	Practicing Physicians*		
	Medical School†	Residency‡	Medical School and Residency§
Arizona	41.4	50.8	69.3
California	70.1	72.2	83.9
Connecticut	18.0	41.5	43.3
Florida	49.8	63.1	80.4
Illinois	31.2	50.1	58.4
Louisiana	40.4	48.7	64.1
Nebraska	23.4	49.8	55.6
New York	37.2	48.4	56.2
Oregon	41.7	55.2	67.6
Pennsylvania	39.1	53.3	63.6
Washington	51 0	52.9	75.9

* The fraction from which the percentages were derived for the first two columns of figures had a denominator consisting of all physicians trained in the state who were practicing in the United States in 1982 and a numerator consisting of all physicians trained in the state who were practicing in the respective state in 1982. For the third column of figures, the fraction from which the percentages were derived had a denominator consisting of all physicians who received both their medical school degree and their residency training in the state and who were practicing in the United States in 1982 and a numerator consisting of all physicians who received both their undergraduate and graduate training in the state and who were practicing in the respective state in 1982.

† This column consists of (*a*) physicians who had completed only medical school in the state and (*b*) physicians who had completed both medical school and residency in the state. The latter group is also included in the next column and makes up the column at the extreme right.

‡ This column consists of (*a*) physicians who had completed only the residency in the state and (*b*) physicians who had completed both residency and medical school in the state. The latter group is also included in the preceding column and makes up the column at right.

§ All the physicians in this column are also included in the preceding two columns.

cent, compared with the national average of 51.1) who had completed residencies there.

Of the 294,650 graduates of U.S. medical schools who were practicing in the United States as of December 31, 1982, 39.3 percent were in the state where they attended medical school. Similarly, 51.1 percent of the 294,650 who received their graduate training in a state remained there to practice. A subset of the 294,650 physicians received both medical school education and graduate training in the same state. This subgroup totaled 134,691 physicians. Of this smaller group of 134,691 physicians, 64.9 percent (87,340) remained in that state to practice. This progressively higher retention rate reflects the results of previous studies (1, 2, 4).

Table 3 displays physician retention rates for the 11 states included in Table 2. The data confirm the results of earlier studies (1, 2, 4) showing that the probability that a physician will practice in the state where he received medical training is higher later in the educational process;

that is, a residency in the state leads to greater retention than medical school in the state. In each case, retention is highest, however, if a physician received both undergraduate and graduate training in the state.

Although, as shown in Table 2, only 6 percent of Arizona's 1982 physicians had graduated from medical school there, 41 percent of the University of Arizona College of Medicine graduates who were in practice in 1982 were practicing in the state of Arizona; and 69 percent of those who received both medical school and residency training remained to practice there (Table 3). Similarly, although most of California's physicians were trained out of state, 70 percent of California medical school graduates stayed, as did 84 percent of those who received both medical school and residency training there. On the other hand, Louisiana retained only 40 percent of its medical school graduates, even though (as shown in Table 2) 70 percent of Louisiana's physicians had graduated in the state.

The authors sought to determine whether the location patterns of foreign medical graduates practicing in the United States at the end of 1982 differed from that of U.S. graduates. The percentages of FMGs who practiced in the state where they received their graduate medical training were strikingly similar to those of U.S. graduates, 51.5 percent compared with 51.1 percent for U.S. medical graduates. As was true for the U.S. graduates, the FMG women physicians, FMG older physicians, FMG general/family practitioners, and FMG psychiatrists had the highest probability of practicing where they received most of their graduate training. Those states with the highest proportions of FMGs trained in-state were similar to those with the highest proportions of U.S. graduates trained in-state; these were the more populous states with higher physician density and higher per capita income.

Discussion

The results of the present study indicate a strong correlation between location of training and location of practice for a physician. They also suggest that the medical education system can be used by a state to increase the number of physicians who practice there.

Variations in the characteristics of the students and schools or of the levels of medical education limit the ability of a state to use its educational system to achieve a preferred number of practicing physicians. Table 1 shows, for example, that women physicians and general/family practitioners were most likely to remain in the state where they received their graduate medical education. If desired, a state could recruit women students or residents in hopes of improving the retention of its graduates. A state could also increase the number of family practice residencies if it wanted to improve retention of family practice physicians, since it is difficult to identify early in their careers which students will subsequently enter family practice. On the other hand, if the state's primary purpose is retention of its graduates, the state should try to limit the number of students who plan to specialize in pathology and the number of pathology residencies.

Similarly, the type of medical school affects retention. Graduates of public medical schools are more likely to remain in the state than graduates of private medical schools. However, this conclusion must be tempered by the fact that most public medical schools give preferential treatment to in-state applicants, thus biasing their retention rates upward. Improving the reputation of a medical school will

probably not alone improve the state's ability to retain graduates in the state. In effect, as a school gains renown, it both attracts students with less attachment to the state and expands the locational opportunities available to its graduates.

It is also clear from this study that the location of a physician's residency exerts a more powerful influence on subsequent practice location than does the location of medical school. This might suggest that a state interested in attracting practicing physicians should concentrate more resources on graduate medical education than undergraduate training. Further, a state may choose to encourage its medical graduates to remain in the state for their graduate medical education. Such a strategy may be hampered by the fact that students choose their residencies in part in locations where they wish to practice in the future. Thus, public policy in this area may have only a minor impact on physicians' choices of practice location.

Another finding showed little variation in state retention rates between U.S. medical graduates and foreign medical graduates. This finding implies that FMGs in residency programs who will remain in the United States can be considered by a state as a resource for future as well as current medical care services, just as U.S. graduates are.

States have adopted a variety of strategies (either explicitly or implicitly) to attract physicians to their states via the medical education system. Louisiana, for example, trains many physicians who leave the state; 70 percent of the physicians practicing in the state in 1982 had graduated from medical school there, but the medical school system had only an average retention rate (40.4 percent compared with 39.3 percent for all states). New York also has an extensive education system that trains most of its practicing physicians (78.6 percent of the physicians practicing in New York received residencies in the state); but the state exports a greater-than-average percentage of the physicians it trains in residencies (only 48.4 percent remain in the state versus 51.1 percent for all states).

California has concentrated its efforts on graduate medical education. Despite a dramatic increase in the number of students graduated from California medical schools in the past two decades (15) and a high retention rate of its graduates, most of the practicing physicians in California earned their medical degrees in other states.

Finally, both Connecticut and Arizona rely heavily on other states to train the physicians who practice there. However, the University of Arizona College of Medicine has been more successful at retaining its graduates than the two medical schools in Connecticut. In addition, residency programs in Arizona have a higher aggregate retention rate than those in Connecticut, and individuals who complete both medical school and residency in Arizona are more likely to stay in the state than such physicians trained in Connecticut.

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DATAGRAM

Results of the NRMP for 1986

The number of U.S. seniors who enrolled in the National Resident Matching Program (NRMP) in 1986 decreased by 198 from a year ago (1). The number who subsequently withdrew decreased by 86, the number of active applicants decreased by 112, and the number who were unmatched decreased by 115.

The total number of other U.S. and Canadian citizens ("fifth pathway" students, U.S. graduates of foreign medical schools, physician candidates [earlier U.S. graduates seeking an entering position in graduate medical education], and U.S. osteopathic school and Canadian medical school graduates) who applied to the match this year decreased by 408. Among these other U.S. and Canadian citizens, the number of fifth pathway applicants decreased from 407 to 305; 240 participated in the match, and 77 percent were successful. The number of graduates of osteopathic schools who initially applied to the match increased from 631 to 774, a three-fold increase since 1983; 67 percent of those in 1986 were matched. The number of physician applicants also increased, and 52 percent were successful in the match.

The number of foreign medical graduates (FMGs) who applied decreased by 1,903. Of the 7,659 who applied, 1,954 were U.S. citizens; the number of U.S. FMGs decreased by 25 percent, and the proportion of U.S. FMGs unmatched increased by 1 percentage point to 61.4 percent. The number of alien FMGs decreased by 18 percent, and the percentage unmatched decreased by 2 percentage points.

The number of positions offered for the first postgraduate year increased by 235; 266 more were offered in the generalist* specialties than in 1985 (Table 2), an increase of 0.7 percentage points to 65.5 percent. The ratio of positions per initially enrolled applicant was 0.7; the ratio of positions per all U.S. senior and other U.S.-Canadian citizen applicants was 0.9, and that per U.S. senior was 1.2. The

TABLE 1

Participation in the National Resident Matching Program in 1986

Category	U.S. Senior Students		Other U.S. and Canadian Citizens*		Alien Foreign Graduates		Total Applicants	
	No.	Percent	No.	Percent	No.	Percent	No.	Percent
Applicants	15,981	100.0	4,924	100.0	5,705	100.0	26,610	100.0
Withdrew	1,244	7.8	1,966	39.9	2,043	35.8	5,253	19.7
Active participants	14,737	92.2	2,958	60.1	3,662	64.2	21,357	80.3
Matched	13,756	93.3	1,501	50.7	879	24.0	16,136	75.6
Unmatched	981	6.7	1,457	49.3	2,783	76.0	5,221	24.4
Total	14,737	100.0	2,958	100.0	3,662	100.0	21,357	100.0

* Other U.S. and Canadian citizens consist of graduating students from U.S. osteopathic schools and Canadian medical schools; physician candidates, that is, earlier U.S. graduates seeking an entering position in graduate medical education; "fifth pathway" students, who are U.S. nationals who completed course requirements for a medical degree abroad followed by a year of clinical training in a U.S. hospital under medical school sponsorship; and U.S. foreign medical graduates.

* "Generalist" specialties are defined as family practice, internal medicine, obstetrics/gynecology, and pediatrics.

TABLE 2

Positions Offered and Filled by Specialty and Type of Applicants in the NRMP in 1986

Specialties	Positions Offered		Applicants Matched											
			U.S. Senior Students			Other U.S. and Canadian Citizens‡			Alien Foreign Graduates			Total Applicants		
	No.	Percent*	No.	Percent		No.	Percent		No.	Percent		No.	Percent	
				*	†		*	†		*	†		*	†
Family practice	2,390	12.7	1,680	12.2	70.3	245	16.3	10.3	35	4.0	1.5	1,960	12.1	82.0
Internal medicine	6,912	36.8	4,994	36.3	72.3	570	38.0	8.2	421	47.9	6.1	5,985	37.1	86.6
Pediatrics	1,944	10.4	1,366	9.9	70.3	168	11.2	8.6	189	21.5	9.7	1,723	10.7	88.6
Obstetrics/gynecology	1,048	5.6	866	6.3	82.6	93	6.2	8.9	15	1.7	1.4	974	6.0	92.9
Psychiatry	932	5.0	651	4.7	69.8	70	4.7	7.5	61	6.9	6.5	782	4.8	83.9
Medical specialties	80	0.4	44	0.3	55.0	3	0.2	3.8	5	0.6	6.3	52	0.3	65.0
Dermatology	9	0.0	5	0.0	55.6	0	0.0	0.0	0	0.0	0.0	5	0.0	55.6
Neurology	50	0.3	22	0.2	44.0	3	0.2	6.0	4	0.5	8.0	29	0.2	58.0
Ophthalmology	21	0.1	17	0.1	81.0	0	0.0	0.0	1	0.1	4.8	18	0.1	85.7
General surgery	2,322	12.4	1,796	13.1	77.3	150	10.0	6.5	48	5.5	2.1	1,994	12.4	85.9
Surgical specialties	504	2.7	450	3.3	89.3	40	2.7	7.9	4	0.5	0.8	494	3.1	98.0
Neurosurgery	31	0.2	27	0.2	87.1	0	0.0	0.0	2	0.2	6.5	29	0.2	93.5
Orthopedics	342	1.8	307	2.2	89.8	33	2.2	9.6	2	0.2	0.6	342	2.1	100.0
Otolaryngology	42	0.2	39	0.3	92.9	1	0.1	2.4	0	0.0	0.0	40	0.2	95.2
Urology	83	0.4	71	0.5	85.5	6	0.4	7.2	0	0.0	0.0	77	0.5	92.8
Plastic surgery	6	0.0	6	0.0	100.0	0	0.0	0.0	0	0.0	0.0	6	0.0	100.0
Support specialties	1,449	7.7	1,007	7.3	69.5	87	5.8	6.0	56	6.4	3.9	1,150	7.1	79.4
Anesthesiology	330	1.8	268	1.9	81.2	9	0.6	2.7	3	0.3	0.9	280	1.7	84.8
Emergency medicine	270	1.4	242	1.8	89.6	23	1.5	8.5	1	0.1	0.4	266	1.6	98.5
Pathology	477	2.5	197	1.4	41.3	31	2.1	6.5	48	5.5	10.1	276	1.7	57.9
Physical medicine	78	0.4	63	0.5	80.8	3	0.2	3.8	2	0.2	2.6	68	0.4	87.2
Preventive medicine	8	0.0	1	0.0	12.5	2	0.1	25.0	2	0.2	25.0	5	0.0	62.5
Diagnostic radiology	265	1.4	223	1.6	84.2	18	1.2	6.8	0	0.0	0.0	241	1.5	90.9
Therapeutic radiology	21	0.1	13	0.1	61.9	1	0.1	4.8	0	0.0	0.0	14	0.1	66.7
Transitional	1,189	6.3	902	6.6	75.9	75	5.0	6.3	45	5.1	3.8	1,022	6.3	86.0
Total	18,770§	100.0	13,756	100.0	73.3	1,501	100.0	8.0	879	100.0	4.7	16,136	100.0	86.0

* Percent distributions of positions offered and filled among specialties (percentages may not add because of rounding).

† Percent of positions offered in specialty that were filled by applicants. §‡ See Table 1 footnote.

§ In addition, 240 postgraduate year-2 positions were offered; 166 U.S. senior students and 16 earlier U.S. graduates were matched to them.

ratios for these three groups of active applicants in the match were, respectively, 0.9, 1.1, and 1.3.

The overall filling of positions decreased by 3 percentage points, the filling of positions by U.S. seniors by 0.9 percentage point, and the filling by other applicants by a total of 1.1 percentage points. The most competitive programs were in emergency medicine, obstetrics/gynecology, orthopedic surgery, and diagnostic radiology. The participation of programs and positions in orthopedic surgery increased slightly. The low number of positions in neurological surgery, otolaryngology, and urology is attributable to the withdrawal of many programs in order to participate in non-NRMP matches. Again, only a few programs in plastic surgery participated in the match. The distribution of matched U.S. seniors among types of programs increased slightly in family practice, pediatrics, obstetrics/gynecology, and psychiatry; and the percentages of U.S. seniors entering general surgery and the support specialties decreased slightly.

Advanced programs for students (postgraduate-year-2 [PGY-2]) positions were again offered in the match this year. Sixty-five programs offered 240 positions. Forty-nine programs in diagnostic radiology offered 180 PGY-2 positions, of which 73 percent were filled with U.S. senior students and 16 percent were filled with physician applicants for a total fill rate of 82 percent. Most of the senior students were also matched to PGY-1 positions in the match. For the 1987 match, the chairmen of anesthesiology and orthopedic surgery programs have indicated their intent to enroll their PGY-2 and PGY-1 programs.

For the third year, couples were not allowed to withdraw from the match to accept positions outside the match, and a paired choice algorithm was used. This change resulted in the participation of 720 individuals as 360 couples; 93 percent of these U.S. students were successfully matched.

Several specialty matches for physician candidates were carried out by the NRMP in 1985. In the summer, 120 programs offered 284 positions for fellowships in respiratory disease; 236 physicians matched to 76 percent of these positions. In the fall, 24 programs offered 46 positions in colon and rectal surgery; 100 percent were filled by 57 percent of the applicants. Late in the fall, 31 programs in emergency medicine offered 179 positions; 99 percent of them were filled by 35 percent of the physician applicants. In the specialty match for dermatology last fall, there were 546 applicants for 223 positions. A total of 217 (40 percent) physicians were matched to fill 97 percent of the positions.

A new match, called the Medical Specialties Matching Program, is underway for fellowships in respiratory disease, plus all of the subspecialties of internal medicine. This match occurred in May 1986 for positions beginning in July 1987.

Data that describe the trends in numbers of positions offered and filled by U.S. seniors and other applicants during the past several years are included in the NRMP's annual directories (2).

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